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WIRELESS ELECTRICITY TRANSMISSION

Abstract: This article discusses wireless electricity transmission, its principles and the main method.

Key words: Electricity, power, transmitter, receiver, charger, generator.

Nowadays life starts to go faster, people tend to be on the go all the time and keep their gadgets with them 24/7. And in the middle of the day nothing can be more disappointing than having your mobile phone dead and not having your phone charger with you. In such moments, we wish we could just put the phone down and it could be wirelessly charged by itself. Luckily, solution to our problem was found as long time ago as back in 2001, when J.M. Fernandez, and J.A. Borras from Motorola made a patent on contactless battery charger with wireless control link. And it took 16 years to make wireless chargers popular and comfortable to use. Now, you can charge your phone anywhere, by just putting it on the charging panel and being able to pick it up anytime. No carrying cables, no worrying about other people having another cable, not suitable for your phone – one type of charger to all types of phones.

Ways of wireless power transmission

In general, the term "wireless energy transfer" is a collective term that refers to a number of different technologies for the transmission of energy through electromagnetic fields. Such technologies, first of all, are characterized by the distance to which they can transmit power with maximum efficiency, as well as the type of electromagnetic energy used: time-varying electric and magnetic fields, radio waves, microwave radiation and visible light waves.

Wireless power transmission concerns a wide variety of applications, including wireless charging of batteries. Recently, both the manufacturer and the consumer have turned their attention to the possibility of wireless

power transmission in installations aimed at the mass consumer, in particular, the technology of wireless charging of batteries.

Method of electromagnetic induction

In a general concept, considering any of the wireless transmission techniques, it can be unequivocally said that the power transmission scheme is based on a transmitting element (antenna or associated coils) connected to a power source and a receiving element connected to a load [3] (Figure 1):

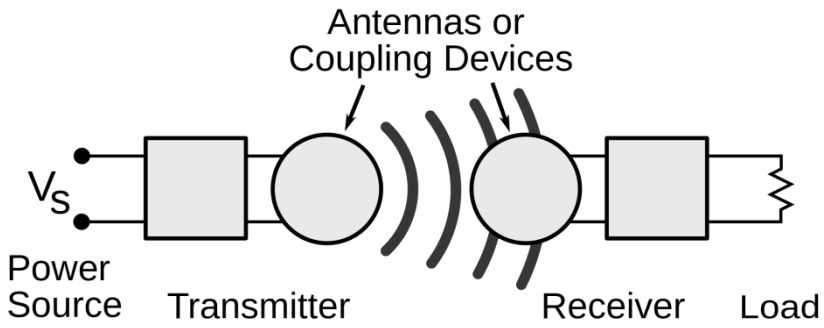

Figure1 - Wireless transmission scheme

The main methods of wireless power transmission are based on electromagnetic field. Due to the phenomenon of mutual induction, an induced current from the primary winding is created on the secondary winding of the device. For effective interaction, a close arrangement of the windings is necessary, since otherwise most of the field energy is wasted. The described device is a transformer familiar to everybody. Indeed, since the windings are not physically connected, the electricity is transmitted wirelessly. This method is used to charge mobile devices, medical implants and electric vehicles. In addition, the method has found application in radio frequency identification (RFID) technologies [2] (Figure 2).

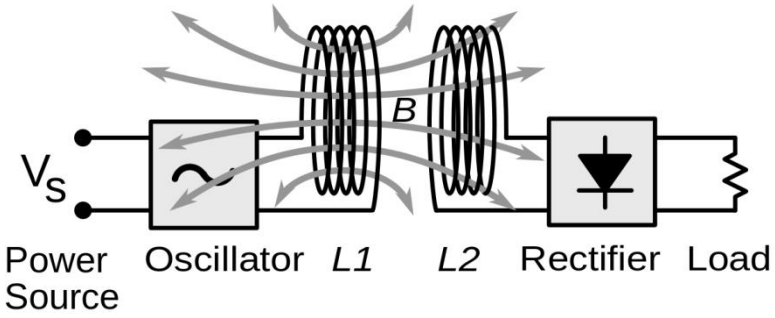

Figure 2 - Magnetic induction transfer scheme

Areas of application of the wireless energy transmission

Speaking about areas of application of the wireless energy transfer, it is necessary to point out that one of the applications of wireless power transmission technology is wireless chargers, named wireless charging of smartphones, tablet computers, digital photo and video cameras and other gadgets. Numerous adapters and chargers of different manufacturers, differing in electrical characteristics and designs, have become a significant problem for owners of this kind of equipment, so the transition to universal chargers is a very important issue for consumers. Often, the user faces the problem of replacing the old charger when buying a new phone or another high-tech gadget. It's also very unfortunate with the unraveling of the "web" wires in the search for the right charger, so the widespread introduction of a universal charger will free users from this kind of problems.

It is especially worth noting that wireless transmission technologies can be successfully used not only in wireless charging of smart gadgets, but also in the industrial sector: charging of vehicles' batteries, implantable devices in medicine, military hardware, as an energy source for LED lighting indoors and etc. In medicine, the use of a variety of implantable devices in the heart of a person requires, over time, recharging them. Such devices are pacemakers, infusion pumps and others, so the widespread introduction of wireless charging systems to replace the batteries in such devices, allows you to abandon the surgical procedure.

Another vivid example of the use of wireless charging is the charging of car batteries. At present, such systems already provide power transmission to vehicles of 3.3 kW with high efficiency at a distance of 10-20 cm. In such a case, in order to carry out charging in an induced manner, the car is enough to be positioned above the transmitter, while the charging process will start automatically [1].

In the military industry, the technology of wireless power transmission is used in military equipment for increasing reliability, safety of electronic devices and ergonomics. These technologies include military helmets in which electronic devices are powered by batteries housed in a soldier's special vest, which eliminates the need for connecting wires or disposable batteries, as well as radio-controlled sappers and various kinds of drones.

The principle of the wireless transmission of electricity based on the phenomenon of electromagnetic induction

The use of technologies for wireless transmission of electricity through the phenomenon of electromagnetic induction received the greatest spread in electrical engineering. Depending on where the radiation source is located, the field of electromagnetic field propagation can be divided into two main zones: near and far zones. The near zone is the zone of induction limited by the distance equal to the wavelength. Also at the interface between the near and far zones there is a transition intermediate zone, in which the induction zone, i.e. the near zone passes into the radiation zone.

The length of the near zone is calculated from the expression according to: $\lambda = \frac{c}{f}$where c is the speed of light equal to 8m/s; f is the propagation frequency of an electromagnetic wave, Hz. For example, at frequencies of an electromagnetic wave of 1, 10 and 100 MHz, the extent of the near zone will be approximately 300, 30 and 3 m, respectively [4].

In conclusion, it is important to underline that currently, the use of wireless power transmission technologies is widely used in the wireless charging of batteries or devices that require frequent recharging. Along with many methods of wireless power transmission there are technologies based on the phenomenon of electromagnetic induction that have become widespread among consumers.

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БЕСПРОВОДНАЯ ПЕРЕДАЧА ЭЛЕКТРИЧЕСТВА

Аннотация: в этой статье отражены сведения о беспроводной передаче электричества. Рассмотрены особенности беспроводной передачи электричества, принципы и основной метод передачи электричества беспроводным путем.

Ключевые слова: Электричество, передатчик, получатель, зарядное устройство, генератор.

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